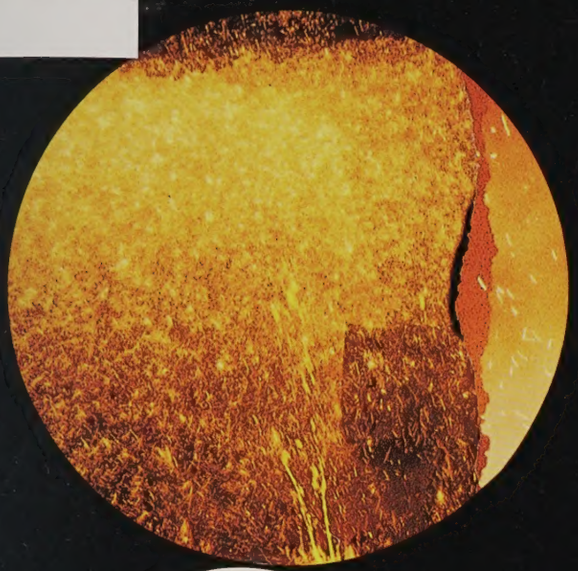
UNITED STATES DEPARTMENT OF AGRICULTURE

A SCIENTIFIC CAREER WITH THE AGRICULTURAL RESEARCH SERVICE



An Equal Opportunity Employer

All appointments and promotions to positions in the Agricultural Research Service (ARS), U.S. Department of Agriculture (USDA), are based on competitive principles. This policy ensures that all persons who are qualified have an equal chance to obtain a position. Selections and promotions are based on merit, without regard to race, color, sex, marital status, religion, age, nondisqualifying physical handicap, national origin, political affiliation, or any other nonmerit consideration.

Qualifications for positions with ARS are determined by educational background, previous work experience and, when appropriate, scores on examinations administered by the U.S. Office of Personnel Management or the employing agency.

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Issued June 1985

Wanted: A Few Promising Scientists

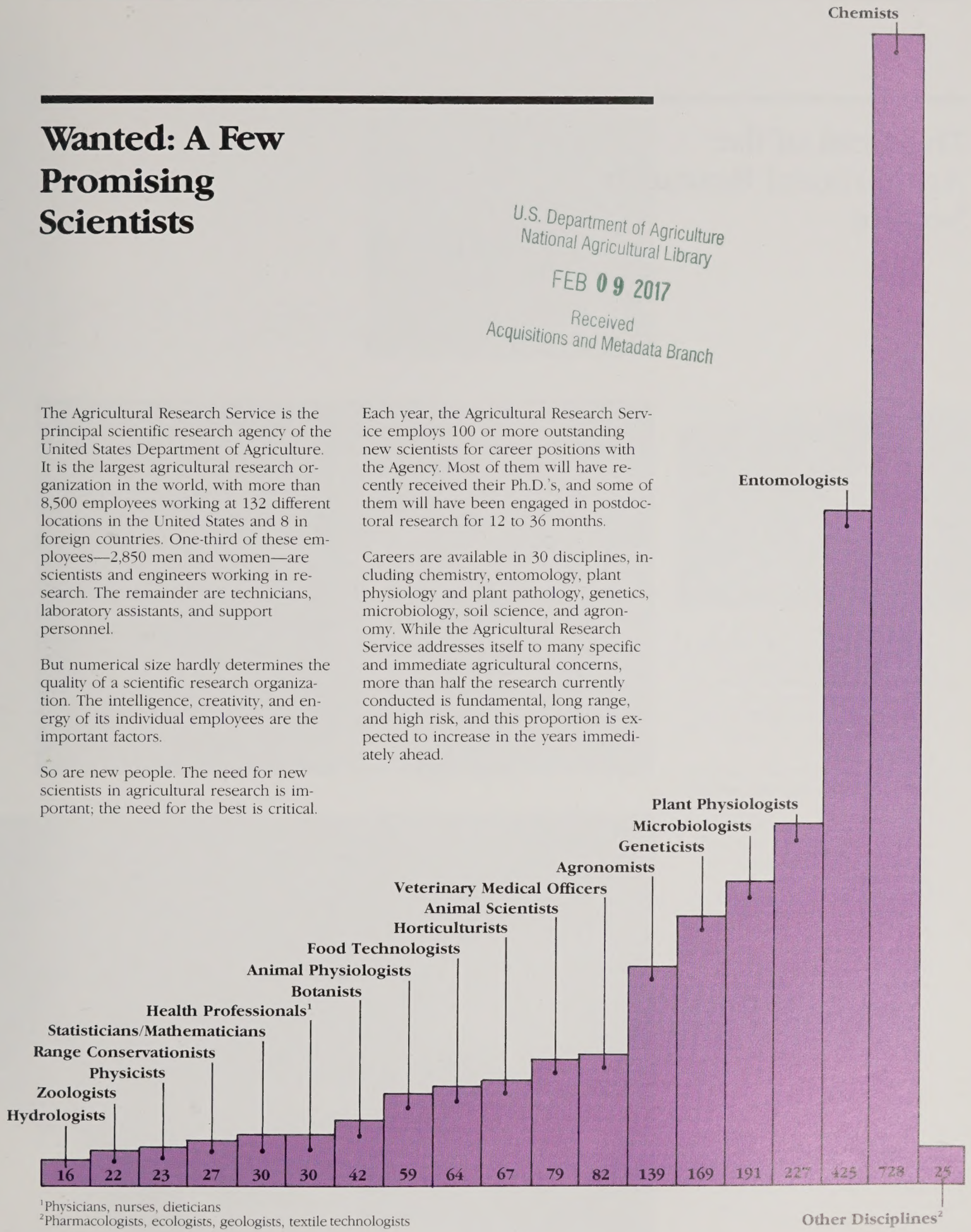
The Agricultural Research Service is the principal scientific research agency of the United States Department of Agriculture. It is the largest agricultural research organization in the world, with more than 8,500 employees working at 132 different locations in the United States and 8 in foreign countries. One-third of these employees—2,850 men and women—are scientists and engineers working in research. The remainder are technicians, laboratory assistants, and support personnel.

But numerical size hardly determines the quality of a scientific research organization. The intelligence, creativity, and energy of its individual employees are the important factors.

So are new people. The need for new scientists in agricultural research is important; the need for the best is critical.

Each year, the Agricultural Research Service employs 100 or more outstanding new scientists for career positions with the Agency. Most of them will have recently received their Ph.D.'s, and some of them will have been engaged in postdoctoral research for 12 to 36 months.

Careers are available in 30 disciplines, including chemistry, entomology, plant physiology and plant pathology, genetics, microbiology, soil science, and agronomy. While the Agricultural Research Service addresses itself to many specific and immediate agricultural concerns, more than half the research currently conducted is fundamental, long range, and high risk, and this proportion is expected to increase in the years immediately ahead.



[1]Physicians, nurses, dieticians
[2]Pharmacologists, ecologists, geologists, textile technologists

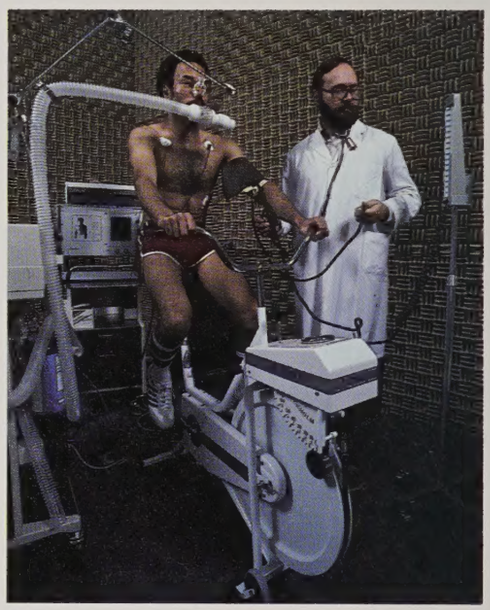
The Goal of the Agricultural Research Service

Through fundamental and applied research, the Agricultural Research Service seeks to provide the means for solving the technical food and agricultural problems of broad scope and high national priority. This research is required to ensure, perpetually, an adequate supply of high-quality food and fiber for the American people and for export.

In pursuing this research goal, ARS seeks to develop the means for—

1) Managing and conserving the Nation's soil and water resources for a stable and productive agriculture;
2) Maintaining and increasing the productivity and quality of crop plants;
3) Increasing the productivity of animals and the quality of animal products;
4) Achieving maximum use of agricultural products for domestic markets and export;
5) Promoting optimum human health and well-being through improved nutrition and family resource management; and
6) Integrating scientific knowledge of agricultural production, processing, and marketing into systems that optimize resource management and facilitate transfer of technology to users.

The Agricultural Research Service can develop the means to solve problems, but it is up to other people and groups—farmers and ranchers, action agencies like the Extension Service, and the private sector—to take steps to achieve these strategic objectives.



Research physiologist Henry Lukaski of the ARS Human Nutrition Research Center, Grand Forks, ND, monitors the response of a live-in volunteer during tests to determine maximal aerobic power. The oxygen consumed by each volunteer is measured periodically during nutrition studies to make sure fitness and body composition remain constant. *Objective 5.*

In East Lansing, MI, Jagdev M. Sharma, a veterinary medical officer, compares two 3-day-old chickens infected with Marek's disease. The one at the top was vaccinated against the disease on the day it was hatched; the healthier bird was vaccinated through the shell while still an embryo. *Objective 3.*

Agricultural engineer John Laflen conducts soil erosion studies at Ames, IA, with a rainfall simulator. He uses the simulator to evaluate the effect on erosion of leaving crop residues on the surface of the soil. *Objective 1.*

Olivia Broome, a horticulturist at Beltsville, MD, uses tissue culture techniques to propagate fruit and berry plants. Some 75 apple shoots have grown in an agar-based medium from a few small clusters implanted 4 weeks earlier. *Objective 2.*

Soil scientist Claude Phené built a computerized "traveling trickle irrigation system" in Fresno, CA, that is laser-guided, senses water needs of plants, and runs on solar energy. The state-of-the-art machine "knows" when to irrigate crops and how much. *Objective 6.*

In Gainesville, FL, agricultural engineers David Slaughter (listening) and J. C. Webb use a stethoscope and other equipment to listen to insect larvae moving and chewing inside a grapefruit. They hope that the method will have commercial application and open up more foreign markets for U.S.-grown fruits and vegetables. *Objective 4.*

The Work of the Agricultural Research Service Today . . . and Tomorrow

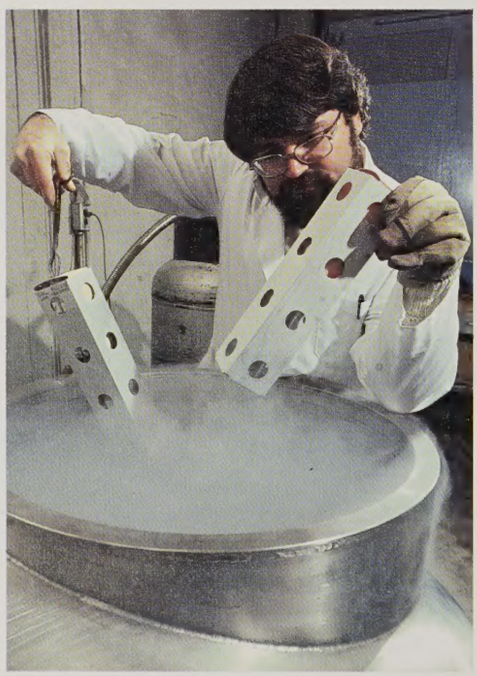
Today Agricultural Research Service scientists are in the vanguard of many exciting areas of research.

One such area is biotechnology. As 1985 began, some 115 biotechnology projects were being conducted at 31 locations, where ARS researchers were employing such state-of-the-art techniques as cell and tissue culture, protoplast fusion, embryo manipulation and transfer, and recombinant gene transfer. A number of these projects involved genetic engineering, a development recently termed by a panel of experts as "one of the four major scientific revolutions of this century, on a par with unlocking the atom, escaping Earth's gravity, and the computer revolution."

Of 50 studies recently selected for the ARS Research Associate Program (see page 16), practically all fall under the heading of biotechnology, and most involve molecular biology. ARS is also cosponsor, together with the University of California and the California State Experiment Station, of a new Plant Gene Expression Center, based at Albany, CA.

Here are a few of the recent developments or discoveries by ARS scientists in biotechnology and other fields. They illustrate the broad range of research currently being conducted.

- Embryos and fertilized eggs that can be transplanted from cows of superior genetic quality to surrogate mothers.
- Low-cost procedures for transferring an "engineered ovum" in a surrogate mother to produce twins, triplets, or even quadruplets from a single egg.
- New rice plants, developed through tissue culture, with more and better quality protein, as well as a method for increasing the protein content of rice flour from 8 percent to 25 percent.
- Dwarf fruit trees that produce higher per-acre yields and are easier to harvest.
- Through molecular biology, new vaccines to prevent diseases in animals and poultry, such as a recent inoculum to curb foot-and-mouth disease in livestock.
- The use of monoclonal antibodies to detect both animal and plant diseases and to study proteins that may form the basis for new animal vaccines.



Phil Stanwood, a research agronomist at the National Seed Storage Laboratory, in Fort Collins, CO, pulls seed samples from a tank of liquid nitrogen where they had been stored at −196 C. for 6 months. Seeds of most crops still germinate after cryogenic storage.

- Importation of more insects to combat insects, including stingless wasps from Europe to protect alfalfa from the alfalfa blotch leafminer.
- Chemicals from insects, plants, and other natural sources which control or disrupt the growth and reproduction of insects.
- Increasing use of sex and other pheromones to trap and eradicate a growing variety of insect pests.
- Many new findings in human nutrition, including the fact that too much salt and not enough potassium in U.S. diets are increasing chances of Americans getting hypertension.
- Solution of many problems associated with no-till farming, to help extend the applicability of this promising system for conserving soil and water.
- Computer models which utilize the knowledge of experts in many scientific fields to monitor and solve a growing number of management and technological problems.

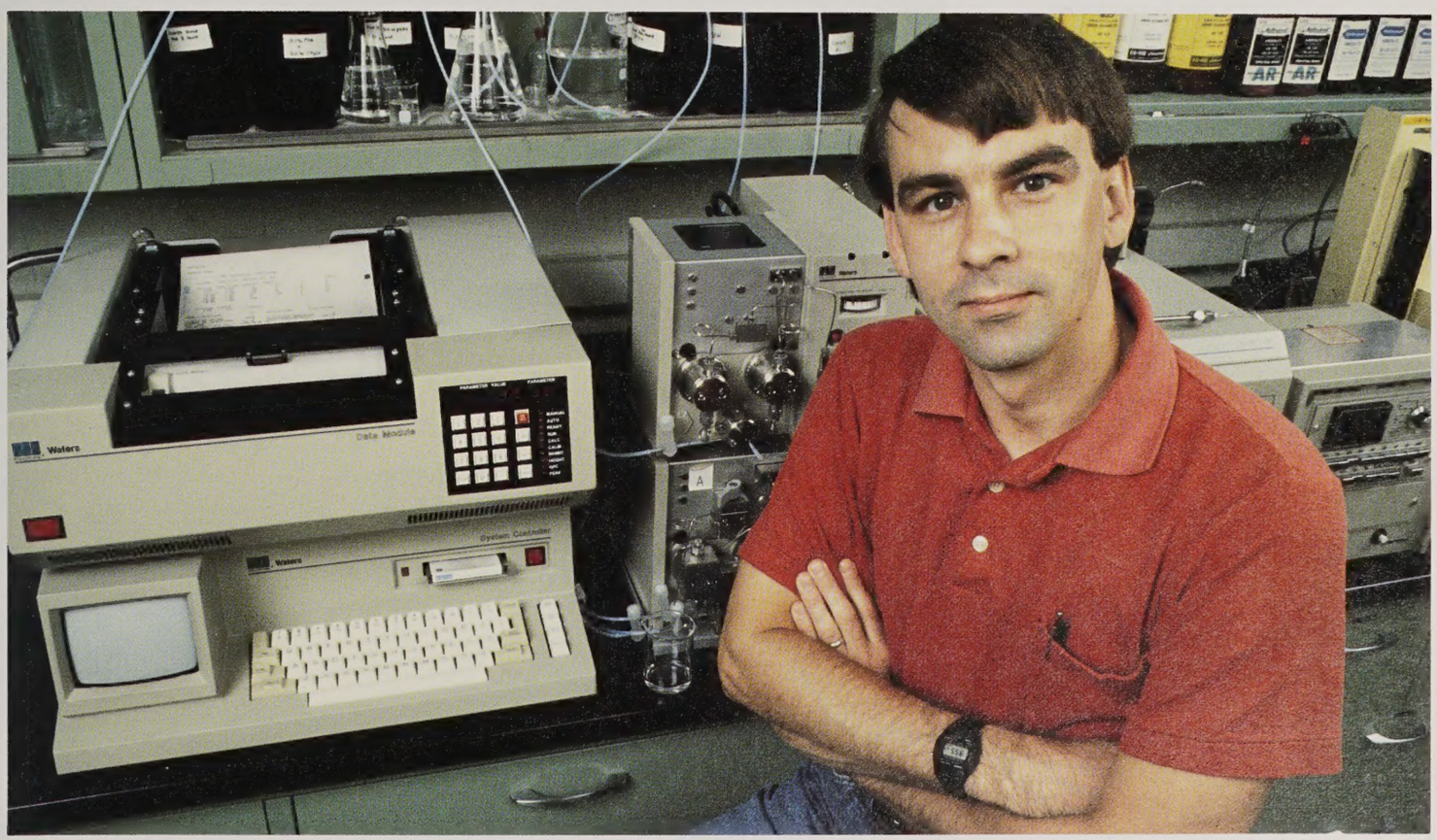
This is but a sampling of recent developments to illustrate the scope of ARS research efforts. Some 5,000 papers a year are published by ARS scientists to describe their discoveries, and more than 3,000 different research projects are underway in the Agricultural Research Service.

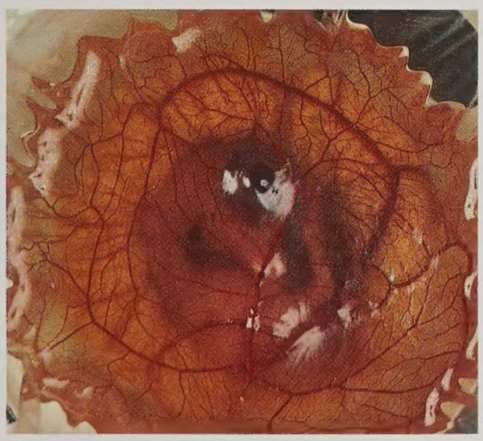
Research With A Payoff

Agricultural research more than pays for itself. Nearly every estimate of the rate of return on investment in agricultural research over the past three decades is between 35 and 45 percent a year, and the production figures for the last 5 years show an annual return higher than 45 percent. One discovery alone, a vaccine against Marek's disease, has saved the U.S. poultry industry at least 2 billion dollars since its release in 1971.

One important goal of agricultural research continues to be greater efficiency that increases the return on investment received by farmers and ranchers.

Chemists Victor Bauder (top) and James Tumlinson, 1984 ARS Scientist of the Year, observe a female tobacco hornworm moth "calling" for a mate by releasing her sex pheromone. Research in Gainesville, FL, under Dr. Tumlinson, has led to identification and synthesis of many insect pheromones.





Turkey embryos are kept alive outside their shells for 27 of 28 days needed for incubation (inset); animal nutritionist Mark Richards studies how they metabolize several trace minerals. Dr. Richards hopes to grow shell-less embryos right through hatching.

Geneticist Lila Vodkin maps the genes of a soybean protein in her Beltsville, MD, laboratory. Dr. Vodkin uses a photographic negative exposed by radioactively labeled nucleotides. Each bar represents a "letter," or nucleotide, in the genetic code.

The future of scientific inquiry in agriculture promises to be just as challenging and exciting as our current research.

We foresee the day when—

- Crops will be much less susceptible to insect damage and disease.
- Insect, weed, and disease control will be carried out effectively without polluting the environment or otherwise endangering human health.
- High crop yields can be sustained without damage to basic natural resources like soil and water.
- More crops will be able to fix their own nitrogen in the soil.
- The rate of efficiency of photosynthesis will be increased from the present 1 percent to as much as 40 percent through enhancement of a plant's energy-conversion systems.

At Clay Center, NE, research geneticist Larry Young (left) and Australian graduate student Neal Fogarty count the number of ovaries of a pubertal ewe with a laporoscope. They evaluate ovulation rate and age at puberty as possible early selection criteria for improving reproductive rates of sheep.

In a field near Fort Collins, CO, plant physiologist Stan D. Wullschleger adjusts a porometer that measures continuously how a corn plant is responding to stress from water deficiency. The information feeds into a computer, which automatically triggers irrigation when the plant reaches a predetermined stress level.

- Through genetics, plant growth will be modified to obtain higher ratios of edible to nonedible parts, longer seed-filling times, improved structural strength, and higher yields of economically important plant constituents.
- The nutritive value of many crops, including small grains, will be improved.
- Plant growth will be regulated to allow harvest of fruits and vegetables of uniform ripeness.
- Sex ratios of animal offspring will be controlled; males or females will be bred as desired.
- Livestock will be protected against damage from insects, parasites, and disease.
- Membrane research will lead to improved crop nutrition, better conversion of solar energy, and targeted delivery of drugs.
- The effects of trace minerals, vitamins, and other nutrients on human health and well-being will be more fully understood.
- Human subjects will enable us to target exactly which nutrients the body needs and in what amounts, in order to improve our diets.
- New foods, from either unexploited plant species or new byproducts, will reduce mankind's dependence on some 18 basic crops, including 5 that provide about 60 percent of human caloric intake.
- Better ways will be found to curb postharvest losses of grain, which in developing countries keep as much as 40 percent of harvested crops from reaching consumers' tables.

The Agricultural Research Service is seeking new scientists with the intelligence, daring, and vision to explore these important scientific areas.

Plant physiologist Archie Portis (left) works with William Ogren, a recent regional ARS Scientist of the Year, on experiments to improve understanding of the regulation of photosynthesis and photorespiration. Portis designed and assembled the instrumentation in the background that separates compounds of pho tosynthesis. Dr. Ogren heads the Photosyn thesis Research Unit at Urbana, Il.

A Long and Distinguished History

The history of scientific research in the U.S. Department of Agriculture is a long and distinguished one. It began with creation of the Department more than 100 years ago. For many years, research was carried out first by departments, and then by several semi-autonomous bureaus. In 1953, most USDA scientific research was relocated within a single agency, the Agricultural Research Service.

On these pages are a few of USDA's scientific pioneers whose landmark discoveries and observations opened doors to broad areas of subsequent development. They include:

- Maurice Hall, who developed better treatments to prevent parasites in animals, including hookworm in dogs, and who courageously swallowed his medicines first to make sure they would not injure animals. His discoveries were applied to livestock and human beings.
- S. Henry Ayers, a bacteriologist who laid the groundwork for present-day sanitary regulations covering handling and pasteurization of milk.
- Merton B. Waite, who discovered in 1891 that insects feeding on pear blossoms transmit pear blight, a disease that kills young branches of the tree.
- Erwin F. Smith, who proved conclusively that bacteria and fungi are leading causes of plant diseases and who identified many such disease agents and the plants most susceptible to them. He was most honored for work on plant tumors.
- William A. Orton, a plant physiologist from Vermont, who had never seen cotton growing before joining USDA. In 1899, in South Carolina, he investigated cotton wilt, then threatening the Cotton Belt, and bred a cotton resistant to the disease. He started the science of breeding disease-resistant plants.
- C.V. Riley, long-time chief of the Bureau of Entomology and first scientist to import one insect to control another. The technique attracted worldwide attention when a Riley team imported the Australian ladybird and successfully controlled "cottony cushion scale" of California citrus.
- Curtis F. Marbut, who in 1909 laid the foundation for the present system of soil classification and mapping and helped build a body of soil science that fitted soil conditions in the United States.

Theobald Smith found in 1890 that tick fever of cattle was caused by a protozoan parasite. He later established that the parasite was spread from animal to animal by the cattle tick. This was the first demonstration that a disease-producing micro-organism can be transmitted by an insect from one animal to another. (Right) Following Smith's discovery, USDA and ranchers sprayed thousands of cattle to control cattle ticks—and the fever.

W.O. Atwater defined major problems to be solved by human nutrition research; he designed first respiration calorimeter (right) to determine the relation of food consumed to energy expended.

Father of first pure food law, Harvey W. Wiley, posing with his so-called "poison squad" in the old USDA Bureau of Chemistry, fought 21 years against adulteration of foods and illegal drugs. He won in 1906, when Congress passed the Food and Drug Act and put his bureau in charge of enforcement.

USDA plant explorer David Fairchild searched the world over for useful plants that could be introduced into the United States.

Marion Dorset proved that a virus, not a bacterium, caused hog cholera. In early 1900's, he developed a two-injection vaccine that provided immunity to this ravaging disease.

Why Join The Agricultural Research Service?

The Agricultural Research Service (ARS) is a satisfying, exciting, and professionally rewarding place for a scientist or engineer to work.

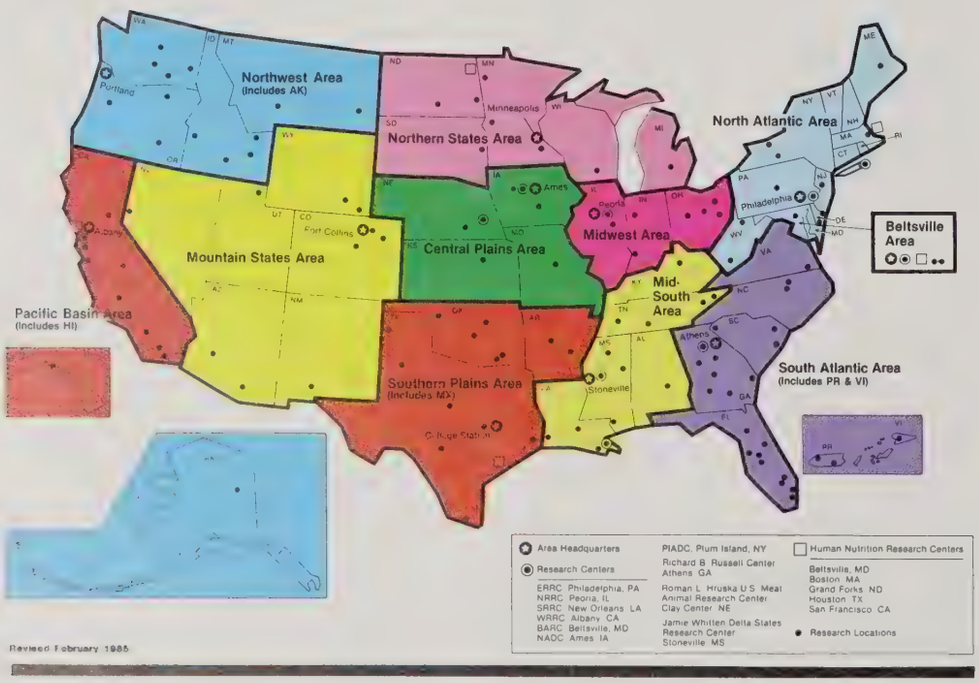
It's *satisfying* because our research solves important problems. ARS scientists provide new approaches and new technologies needed by farmers, ranchers, and industry. We seek ways to produce more and better food and fiber . . . to control insect pests and weeds safely . . . to get food to consumers in better condition . . . to improve human nutrition . . . to help protect soil, water, and air . . . and to find new uses for agricultural commodities.

It's *exciting* because so much of our work is on the leading edge of each discipline . . . in highly visible programs with broad public support. Current research involves biotechnology, including molecular biology, genetic engineering, and membrane research . . . application of theories of artificial intelligence to computer technology . . . innovative approaches to pest control through insect neurochemistry and the use of pheromones. Each ARS scientist is employed because of his or her unique capability as a researcher.

It's *professionally rewarding* because each ARS scientist is a full-time researcher, with no other commitments. Our researchers work in modern, well-equipped laboratories and enjoy a free and open association with colleagues inside and outside the Agency—in universities and industry.

A scientist's professional growth opportunities are limited only by his or her research capabilities. Paid attendance at professional meetings and symposia, assistance in securing Agency patents, and a stable financial environment help make a career with ARS rewarding and satisfying.

Agricultural Research Service - Area Organization



Revised February 1985

In developing and selecting improved cultivars and rootstock of walnuts, horticulturist Gale McGranahan uses such new approaches as somatic embryogenesis and tissue culture. The mass propagation techniques being investigated by Dr. McGranahan and her colleagues in Davis, CA, are expected to speed the development of superior cultivars by years over conventional grafting.

Hydrologist Thomas J. Jackson uses an infrared thermometer to calibrate microwave antennas above a test plot of sorghum in Beltsville, MD, in close-proximity "controlled condition" experiments. Dr. Jackson is cooperating with the National Aeronautics and Space Administration and other agencies on remote sensing of soil moisture from orbiting space platforms.

Microbiologist Jeff Karns studies bacteria that degrade pesticides at the ARS Pesticide Degradation Laboratory at Beltsville, MD. Dr. Karns and his associates have found a way to make it easier for soil microbes to detoxify hazardous wastes

Questions and Answers about Jobs with ARS

1.) How can I learn about job openings in ARS?
ARS announcements of job openings are available at college placement offices and Federal Job Information Centers. Professional societies and faculty members associated with ARS may also have information on vacancies, and position announcements are posted at ARS laboratories and research facilities—many of which are located on or near college campuses. You may also obtain job information by writing to the USDA Agricultural Research Service, Personnel Division, Bldg. 003, Beltsville, MD 20705.

USDA research jobs in the *life sciences* are advertised periodically in a vacancy listing. You must apply for a specifically announced vacancy. After your basic qualifications are reviewed, your undergraduate and graduate work, references, and other materials are evaluated by scientists in your field against the requirements of the job. Those applicants identified as best qualified for the position are referred to the selecting official or supervisor of the position for final consideration and selection.

2.) What are the starting salaries?
Candidates with doctoral degrees in appropriate fields of study usually begin at the GS-11 or GS-12 level in the Federal pay scale.

3.) How do I apply for a position with ARS?
The key to all career employment with the Federal Government is the Standard Form 171 "Application for Federal Employment." After learning about a vacancy, you should complete the Standard Form 171 and submit it to the personnel office identified on the vacancy announcement. A copy of your college transcript may also be required.

The "SF-171" can usually be obtained from Federal offices anywhere in the country and from most post offices as well. It is also available at most college placement offices. The form will enable you to list your qualifications, educational background, job experience, references, and other factors relevant to your potential employment with ARS. Please fill out the form carefully and completely to avoid any delay.

Be sure to submit the SF-171 in time to meet the closing date for accepting applications as specified on the vacancy announcement.

4.) Must I be a U.S. citizen to work for ARS?
U.S. citizenship is required for employment as a career scientist with ARS.

5.) How does ARS make selections?
The selection of new scientists is based on their education and research backgrounds and the specific needs of the Agency. ARS professional scientific positions generally require a doctoral degree (or substantial progress toward a doctoral degree) in one of the physical or biological sciences. Written tests are not part of the selection process.

ARS employs scientists from a wide range of disciplines. We invite you to examine the chart (page 1) showing our current distribution of scientific talent.

6.) What opportunities exist for my professional development?
Because USDA must respond promptly to the changing technological needs of U.S. and world agriculture, ARS scientists must keep up to date on the most significant advances in their respective fields of research. To maintain the highest level of scientific expertise, ARS provides its scientists with as many opportunities as possible for professional development.

ARS encourages its researchers to attend scientific meetings, symposia, conferences, and conventions around the United States and throughout the world. Travel and participation expenses are usually paid by the Government. The proximity of most ARS facilities to college and university campuses also serves as an inducement to continuing education, and research-related graduate and postgraduate courses can often be taken at Government expense during official time or off-duty hours.

Professional development can also include supervisory, managerial, and administrative training, and a number of courses from governmental and nongovernmental sources are available for this purpose.

Plant pathologist Lawrence Pusey coated the peach at the top with a suspension of *Bacillus subtilis*, protecting it against brown rot disease, which ravaged the unprotected peach. Dr Pusey is pursuing his research at the ARS Southeastern Fruit and Tree Nut Laboratory in Byron, GA.

In Peoria, IL, Pat Slininger, a research chemical engineer, studies yeasts from the ARS culture collection to ferment ethanol from xylose found in agricultural residues. Her goal is development of an immobilized yeast cell process that is continuous and that permits production of ethanol as it is simultaneously isolated from the fermentation broth.

7.) How does ARS reward excellence in job performance?

ARS strongly believes that recognition of a job well done is the best motivation to encourage and sustain outstanding performance. Meaningful recognition can take many forms. In addition to official commendations, for example, the ARS "Scientists of the Year" each receive substantial cash awards and additional funding and support for their respective research programs.

ARS employees can also receive recognition from outside the Federal sector. Organizations such as the Alexander von Humboldt Foundation, the American Institute of Nutrition, and the National Cotton Council of America, as well as colleges and universities and numerous professional societies, have often presented ARS scientists with cash awards, prestigious honorary distinctions, and sabbatical teaching assignments.

8.) Am I likely to be relocated while working with ARS?

Relocation is not a requisite for advancement within ARS, and many scientists have risen to the highest grade levels while remaining at the same research location. However, ARS laboratories and research stations are established in climates and geographical areas appropriate to the

Entomologist Mark Feldhaufer (right) discusses high pressure liquid chromatography of molting hormones of tobacco hornworms with Malcolm Thompson, who in 1983 was selected ARS Scientist of the Year for the Northeast, for his work in steroid chemistry.

agricultural problems being investigated, and scientists may have to be relocated if the need for their expertise shifts to other parts of the country. Also, because of the diversity of programs and facilities within ARS, scientists may prefer to seek new research challenges at other locations.

9.) How will my research position be evaluated?
In ARS, research scientists' positions are evaluated at set intervals by panels. The panels consist of a management representative, a personnel representative, and 5 research scientists. Two of the research scientists on the panel must be in the same or similar work area as the researcher being evaluated. The information submitted to the panel for review is prepared by the scientist and includes summaries of the scientist's most important accomplishments and selected publications.

10.) What is the attitude and policy of ARS toward its scientists publishing their research findings?
Technology transfer and the timely dissemination of new knowledge are essential to the overall mission of ARS. The research process is considered incomplete until the results are reported and made available to the scientific community at large. ARS scientists are encouraged to present their findings in refereed journals as well as in Agency and Department publications. Personal recognition and full professional credit are always given for authorship.

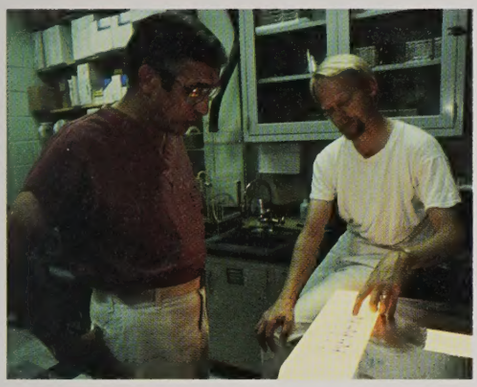
11.) Am I allowed to benefit financially from publications or patents based on my research with ARS?
ARS is a public agency, and its research ultimately belongs to the American people. ARS publications are not copyrighted and can be used freely by the public. Patents based on ARS research are owned by the Agency, and all license fees and royalty payments go to the Government. However, ARS patents can enhance one's professional status inside and outside the Agency.

12.) What benefits does ARS offer in addition to salary?
Fringe benefits in Federal jobs are changing but generally compare well with those in private industry.

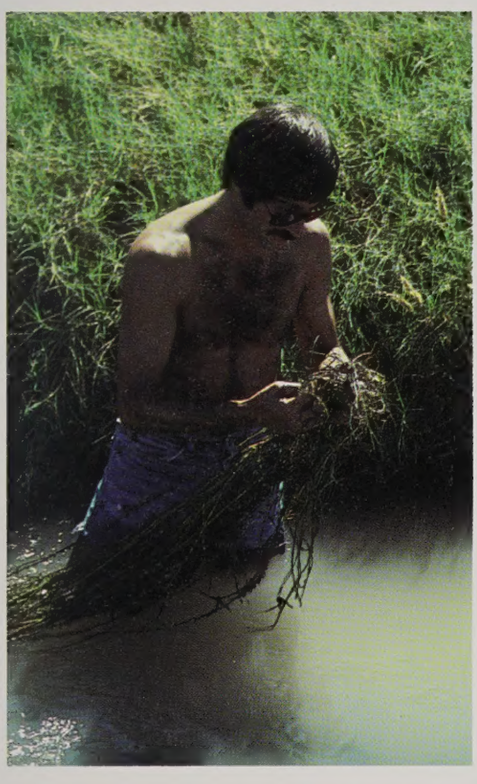
Federal employees receive a generous amount of annual (vacation) leave and sick leave, along with 10 paid holidays. Depending on length of Government (including military) service, annual leave ranges from 13 to 26 days per year. In addition to vacations, annual leave can be used for personal business and family matters. Sick leave is provided for medical and dental appointments as well as for periods of illness. It accumulates indefinitely at the rate of 13 days per year regardless of length of service.

Federal employees who desire health insurance for themselves and their families can select from a variety of plans for which the Government pays approximately half the premium. Life insurance is also available at attractive rates.

Agricultural engineer Lyle Carter (right) and assistant Warner Grayson stand on deck of the ARS Wide Tractive Vehicle at Shafter, CA. It is being used for crop production and soil and water management studies on noncompacted soil. Thirty feet wide, the vehicle runs on elevated "tracks," and will accommodate all kinds of equipment—tillage, planting, spraying, and harvesting



Veterinary scientist Steve Bolin (right) and microbiologist Manual Coria of the ARS National Animal Disease Center, Ames, IA, discuss studies aimed at detecting biologic and molecular differences between closely related viruses that cause fatal diarrhea in cattle. Their research will lead to improved vaccines and diagnostic tests.



Near El Centro, CA, plant physiologist Lars Anderson examines a tangled handful of hydrilla, an aquatic weed that infests canals and waterways in California, Arizona, Florida, and most recently, the Potomac River between Maryland and Virginia. Dr. Anderson heads a team looking for ways to control this and other destructive aquatic pests.

Paul Bishop, a research microbiologist in Raleigh, NC, discovered a new enzyme system that catalyzes the fixation of atmospheric nitrogen. Genetic engineering technology was used to clone and transform DNA segments found to be specific for the new system.

An Unusual Opportunity

The ARS Postdoctoral Research Associate Program

Even after earning their doctoral degrees, many scientists are still uncertain about their professional future and remain at academic institutions in order to continue their studies while exploring career possibilities in both the public and private sectors. With this in mind, ARS offers new Ph.D.'s a chance to compete in its Postdoctoral Research Associate Program. This Program provides for short-term, noncareer appointments to salaried positions on specific research projects. There is a minimum of red tape attached to such appointments.

Established by ARS in 1981, the Postdoctoral Research Associate Program offers a unique opportunity for recent recipients of the doctoral degree to conduct critically needed basic research in association with some of the most prominent scientists in their field. It also enables them to receive advanced and highly specialized training and experience that may not be available anywhere else.

Research Associate appointments can last up to 2 years and are intended for persons with no more than 2 years' postdoctoral experience. All applicants must have a Ph.D. before coming on board.

Associates are usually hired at the professional grade of GS-11. They earn vacation and sick leave at the same rates as all new employees in the Federal Government. In most cases, the costs of moving one's family and household effects to the duty station are reimbursed by the Government. Associates with appointments for more than 1 year are also eligible for health and life insurance benefits.

James R. Frederickson, research associate and soil microbiologist, examines Vogel wheat test plot with world-renowned ARS plant breeder Orville Vogel, one of the leaders of the "green revolution." Dr. Frederickson works in Pullman, WA, with Robert Papendick, studying colonization of inhibitory bacteria on wheat roots.

Research associate Sue Mischke is a geneticist who works with veteran ARS plant physiologist Lowell D. Owens on a gene transfer study, which received ARS's prestigious T.W. Edminster Award. Most such experiments have been with a chemical to induce cell fusion or a bacterium to induce gene transfer; Dr. Mischke induces cell fusion with electricity.


TYPE 545A OSCILLOSCOPE
TIME BASE A
HORIZONTAL DISPLAY
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